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Colorado Department
of Public Health
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Hazardous Materials and Waste Management Division Air Screening Concentrations Table

The Division has prepared a table listing indoor air remediation goals and action levels for a number of volatile organic compounds to be used at sites where vapor intrusion may be a concern. This was prompted in response to the U.S. Environmental Protection Agency (EPA) having released a new assessment of the health effects of trichloroethene (TCE) and tetrachloroethene (PCE), two commonly used degreasing solvents. Existing air concentrations were also updated to incorporate the 2009 EPA risk assessment guidance for the inhalation pathway presented in Risk Assessment Guidance for Superfund (RAGS) Part F¹.

These new air screening concentration table values replace those that may be present in other older guidance documents, such as Table 1 found in the March 2006 "Dry Cleaner Remediation Guidance Document." With the release of this new table, the Division hereby withdraws the use of both the August 20, 2004 and August 17, 2006 interim risk evaluation and management policies for TCE and PCE, respectively.

Development and quality checking of the numbers listed in the Air Screening Concentrations Table will be an ongoing process and readers are encouraged to report any errors that may be discovered to the Division. Please be sure to consult the footnotes to the table when using these table values.

If you have questions about the derivation or application of these table values, please contact the Division by email sent to comments.hmwmd@state.co.us. Please be sure to put "Avramenko" in the subject line.

¹ U.S. EPA (2009). Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment). OSWER 9285.7-82; January 2009. Office of Superfund Remediation and Technology Innovation. EPA, Washington D.C.

Air Screening Concentrations

Volatile organic compounds are chemicals that have a high vapor pressure (molecular weight < 200 g/mol and Henry's Law Constant > 10⁻⁵ atm m³/mol) and easily form vapors at normal temperature and pressure. This definition applies to a large number of organic compounds, many of which are manufactured chemicals. From this long list of chemicals, the Department has chosen those typically found in the environment at chemical release sites.

The analytical method presently being used to determine the concentrations of VOCs in indoor air is the *Compendium Method TO-15*, selected ion monitoring (SIM) mode, as specified in EPA document EPA/625/R-96/010b using the specific *Colorado Guidance for Analysis of Indoor Air Samples* (April 2000) (www.colorado.gov/cs/Satellite/CDPHE-HM/CBON/1251615961696). The laboratory must demonstrate to the Department its ability to perform this analysis with quantitatively reliable results down to levels that equate to health-based concentrations for the chemicals of concern.

Target indoor air concentrations for those chemicals not included on this list may be found in the EPA Regional Screening Level table. Always check for the most recent version of the EPA Regional Screening Level table, the link to which is: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_bwrun_NOV2011.pdf

Chemical Abstracts No.	Chemical Name (IUPAC)	Risk Basis C=Cancer NC=Noncancer	Residential Remediation Goal ¹ (R=10 ⁻⁶ , HQ=1) µg/m ³	Residential Action Level (R=10 ⁻⁵ , HQ=1) ug/m ³	Worker ⁶ Remediation Goal (R=10 ⁻⁶ , HQ=1) ug/m ³	Worker ⁶ Action Level (R=10 ⁻⁵ , HQ=1) ug/m ³
71-43-2	Benzene	C ¹	0.31	3.1	1.6	16.0
56-23-5	Carbon tetrachloride	C ¹	0.41	4.1	2.0	20.0
108-90-7	Chlorobenzene	NC ²	52	52	220	220
67-66-3	Chloroform	C ¹	0.11	1.1	0.53	5.3
95-50-1	1,2-dichlorobenzene	NC ³	210	210	880	880
106-46-7	1,4-dichlorobenzene	C ⁴	0.22	2.2	1.1	11
107-34-3	1,1-dichloroethane	C ⁴	1.5	15	7.7	77
107-06-2	1,2-dichloroethane	C ¹	0.094	0.94	0.47	4.7
75-35-4	1,1-dichloroethene	NC ⁵	7.3	7.3	30.1	30.1
156-59-2	Cis-1,2-dichloroethene	--	No value*	No value*	No value*	No value*
78-87-5	1,2-dichloropropane	C ⁴	0.24	2.4	1.2	12
100-41-4	Ethylbenzene	C ⁴	0.97	9.7	4.9	49
75-09-2	Methylene chloride	C ¹	5.2	52	26	260
100-42-5	Styrene	NC ¹	1,000	1,000	4,400	4,400
79-34-5	1,1,2,2-Tetrachloroethane	C ⁴	0.042	0.42	0.21	2.1
127-18-4	Tetrachloroethene	--	9.36 (C ¹)	41.7 (NC ¹)	47.2 (C ¹)	175 (NC ¹)
108-88-3	Toluene	NC ¹	5200	5200	22,000	22,000
71-55-6	1,1,1-Trichloroethane	NC ¹	5200	5200	22,000	22,000
79-00-5	1,1,2-Trichloroethane	--	0.15 (C ¹)	0.21 (NC ²)	0.77 (C ¹)	0.88 (NC ²)
79001-6	Trichloroethene	--	0.43 (C ¹)	2.1 (NC ¹)	3.0 (C ¹)	8.8 (NC ¹)
75-01-4	Vinyl chloride	C ¹	0.16	1.6	2.8	28
1330-20-7	Xylenes (Mixture/Total)	NC ¹	100	100	440	440

Note: Indoor air target concentrations based on non-carcinogenic risk correspond to a hazard quotient (HQ) of 1. For facilities where multiple non-carcinogenic chemicals are present, HQ values should be divided by a factor of 10 to account for additivity. If adjusted table values are exceeded, consultation with a toxicologist is recommended to assess likely impact on specific target organs.

*- Currently, no toxicity value is available for the inhalation pathway. Please contact the Department for additional information on a site-specific basis.

IUPAC – International Union of Pure and Applied Chemistry

¹ Source of toxicity value: EPAIRIS; ² Source of toxicity value: EPA PPRTV; ³ Source of toxicity value: EPA HEAST

⁴ Source of toxicity value: Cal EPA; ⁵ Source of toxicity value: CDPHE

⁶ Worker values are considered protective for indoor office workers with occasional contact with outdoor soil, and for outdoor workers engaged in light to moderate activity. Values are NOT APPLICABLE to outdoor workers routinely engaged in contact-intensive activity. For facilities where contact intensive use is anticipated, additional analysis and consultation with a toxicologist will be required to determine appropriate site-specific inputs to the risk equations.

The screening values are derived from a variety of sources. Parties using this table should periodically check these sources to verify that the posted values are still in use.

March 12, 2012 Version

Application of Screening Levels for Carcinogens Example of Benzene

Risk Range	Action Required	Residential Use Air ($\mu\text{g}/\text{m}^3$)	Worker Use Air ($\mu\text{g}/\text{m}^3$)
Less than or equal to 1×10^{-6} or background	No Further Action, measures to reduce PCE concentrations in air not required	≤ 0.31	≤ 1.6
Between 1×10^{-6} and 1×10^{-5}	Provided soil and/or ground water contamination is being remediated as approved by the Department, continued monitoring of indoor air is likely unnecessary.	0.31 to 3.1	1.6 to 16
Greater than 1×10^{-5}	Further study needed to determine whether or not the source is from subsurface releases. Mitigation is required it is determined that the vapors are derived from a subsurface source.	> 3.1	> 16

Application of Screening Levels for Mixed Cancer and Noncancer Effects Example 1: Tetrachloroethene (PCE)

Risk Range	Action Required	Residential Use Air ($\mu\text{g}/\text{m}^3$)	Worker Use Air ($\mu\text{g}/\text{m}^3$)
Less than or equal to 1×10^{-6} or background	No Further Action, measures to reduce PCE concentrations in air not required	≤ 9.36	≤ 47.2
Between 1×10^{-6} (cancer) and HI=1 (noncancer)	Provided soil and/or ground water contamination is being remediated as approved by the Department, continued monitoring of indoor air is likely unnecessary.	9.36 to 41.7	47.2 to 175
Greater than HI=1	Further study needed to determine whether or not the source is from subsurface releases. Mitigation is required it is determined that the vapors are derived from a subsurface source.	> 41.7	> 175

Application of Screening Levels for Mixed Cancer and Noncancer Effects

Example 2: Trichloroethene (TCE)

Risk Range	Action Required	Residential Use Air ($\mu\text{g}/\text{m}^3$)	Worker Use Air ($\mu\text{g}/\text{m}^3$)
Less than or equal to 1×10^{-6} or background	No Further Action, measures to reduce TCE concentrations in air not required	≤ 0.43	≤ 3.0
Between 1×10^{-6} (cancer) and HI=1 (noncancer)	Provided soil and/or ground water contamination is being remediated as approved by the Department, continued monitoring of indoor air is likely unnecessary.	0.43 to 2.1	3.0 to 8.8
Greater than HI=1	Further study needed to determine whether or not the source is from subsurface releases. Mitigation is required it is determined that the vapors are derived from a subsurface source.	> 2.1	> 8.8

Application of Screening Levels for Non-Carcinogens

Example of 1,1-Dichloroethene (1,1-DCE)

Risk Range	Action Required	Residential Use Air ($\mu\text{g}/\text{m}^3$)	Worker Use Air ($\mu\text{g}/\text{m}^3$)
Less than or equal to HQI=1 or background	No Further Action, measures to reduce 1,1-DCE concentrations in air not required	≤ 7.3	≤ 30.1
Greater than HQI=1	Further study needed to determine whether or not the source is from subsurface releases. Mitigation is required it is determined that the vapors are derived from a subsurface source	> 7.3	> 30.1

For sites with multiple contaminants or exposure pathways, cleanup levels should result in a cumulative hazard quotient equal to or less than one for all those constituents with similar critical endpoints.

For sites with multiple contaminants, cleanup levels should be set so that the risk posed by individual constituents does not exceed a 1×10^{-6} and where the cumulative (total) excess upper bound lifetime risk from all contaminants does not exceed a 1×10^{-5} .

In all cases, further analysis may be warranted if an action level is exceeded that would trigger the need to mitigate exposures, particularly if it is believed that the constituents are derived from sources other than what may be present in soil or ground water. In these cases, lines of evidence should be examined to determine whether the observed concentrations are from a subsurface source or background (activities/products within the structure being sampled). If the lines of evidence indicate a subsurface source, the Division will require remedial actions to mitigate exposure. A discussion on conducting a line of evidence analysis may be found in Section 4.1 of the CDPHE's September 2004 *Draft Indoor Air Guidance* (www.colorado.gov/cs/Satellite/CDPHE-HM/CBON/1251615961696) and Section 3.7.3 of ITRC's January 2007 *Vapor Intrusion Pathway: A Practical Guideline* (<http://www.itrcweb.org/Documents/VI-1.pdf>).